

A NEW SPECIES OF FOSSIL FROG FROM THE
INTER-TRAPPEAN BEDS OF WORLI HILL, BOMBAY.

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(With one plate).

The species of fossil frog described here comes from the Frog Beds at the Worli Hill on the west coast of Bombay. A full account of these beds is given by Carter,¹ Buist,² Wynne³, and Ribeiro.⁴ These are fresh-water Inter-trappean shale beds belonging to the upper part of the Deccan Trap Series, and are probably of the early Eocene age. These shales are light to dark grey in colour, often rather fragile, fine to coarsely grained, much impregnated with carbonaceous matter, and are full of minute kidney-shaped carapaces of crustaceans. Among the fossils thus far recorded from these beds, are *Cypris semi-marginata* Carter, *C. cylindrica* (Sowerby), *C. sp.*, *Platemys leithi* (Carter), *Indobatrachus pusillus* (Owen), an indeterminate large-sized species of frog,⁵ some fresh-water gastropods probably referable to *Melania* and *Pupa*, some plant stem, seed and leaf impressions.

Though the earliest occurrence of the Salientia dates back to the upper Jurassic times,⁶ their fossil record, on the whole, is very incomplete. This is due mainly to the fact that frogs in general make poor fossils. But, as the study of the present-day distribution of the frog fauna and the routes of migration and the lines of evolution of their various families, must take into consideration the palæontological evidence, it is of the utmost importance that every fossil find of the Salientia, howsoever poorly preserved, be critically examined and put on record.

In India fossil frogs have, since long, been known to occur in the Inter-trappean beds at the Worli Hill, Bombay. They were first described by Owen ⁷ in 1847, as *Rana pusilla*. Stoliczka⁸

¹ Carter 1857, p. 116.

² Buist 1857, p. 169.

³ Wynne 1866, p. 173; *ibid.* 1869, p. 385.

⁴ Ribeiro 1921, p. 582.

⁵ Dr. Leith found a part of the posterior extremities of a large-sized frog computed to be nearly three inches long, Vide Carter 1857, p. 139; Lydekker 1887, pp. 68, 77.

⁶ Woodward 1932, p. 231; Moodie 1912, p. 286.

⁷ Owen 1847, p. 224.

⁸ Stoliczka 1869, p. 386.

re-examined and transferred them to the genus *Oxyglossus* (or *Oxydozyga* as it is now known) which is found in south-eastern Asia and the neighbouring islands. Noble¹ in 1930 recognised the bufonid nature of these frogs and transferred them to the genus *Indobatrachus*, which was created for their reception.

While studying the fossils collected by the present writer from the Worli Hill, associated with *Indobatrachus pusillus* (Owen), were found some specimens which differed from it mainly in having a less acutely rounded snout and a relatively longer vertebral column. These are described here as constituting a new species. The material available for study is in skeletal condition and rather ill-preserved. The cranium is crushed down in the plane of partings in the shale laminae, rendering the various constituent bones obscured and rather difficult to be distinguished. The material was examined in xylol under a low-power microscope so as to bring out clearly the various details which cannot be observed on dry surfaces. In view of the frequent dislodgement of the head from the shoulders, and of the pelvis from the vertebral column, the lengths of these parts were measured separately to ensure the accuracy of the measurements.

The author very much regrets that the fossils and the matrix being very closely similar in the shade of grey, the photographs could not be better.

SYSTEMATIC POSITION.

That the specimens under consideration do not belong to the liopelmid frogs, is evident from the fact that they have eight pre-sacral vertebrae, no ribs and two condyles on the coccyx; the last character also excludes the pelobatids. Because of the pro-coelous vertebrae and the absence of the ribs in these specimens, the Discoglossidae are eliminated. The Pipidae are ruled out on the ground that our specimens have pro-coelous vertebrae. The broadly expanded diapophyses of the sacral vertebra clearly show that these frogs cannot be included in the Ranidae nor in the Polypedatidae. In most of the specimens available, all the digits are very well preserved, and the absence of any inter-calary cartilages or any space for them is beyond doubt; this excludes the Hylidae. The procoelous nature of the vertebrae is present in the Bufonidae and a few of the brevicipitid genera.² But, the pro-coelous nature of the vertebrae combined with the presence of the free inter-central discs, the arched clavicle divergent to the coracoid, the maxillary teeth and the broadly expanded sacral diapophyses clearly show that our specimens must be assigned to the Bufonidae and not to the Brevicipitidae.³

Though the cranial region is much crushed, it is possible, from an examination of a number of specimens, to verify the presence of the nasals, which were probably free, the palatines, the fronto-parietals separated by the median ethmoid and the T-shaped para-sphenoid; further, the presence of teeth on the maxillaries, pre-maxillaries and on the pre-vomers is clearly indicated by sockets. These features along with the above-mentioned bufonid characters show that these specimens under consideration belong to Noble's genus *Indobatrachus*.⁴

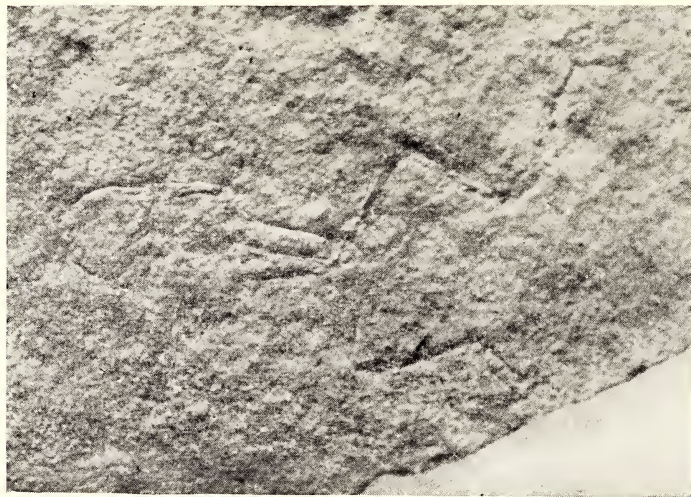
¹ Noble 1930, p. 2.

² Gadow 1923, pp. 143, 152, 160, 185, 237.

³ Noble 1930, pp. 4-7; Gadow 1923, p. 166.

⁴ Noble 1930, pp. 2-9.

NEW SPECIES OF FOSSIL FROG.



Indobatrachus trivialis sp. nov., approx. $\times 1\frac{1}{2}$ '

DESCRIPTION OF THE SPECIES.

Family: Bufonidae.

Genus *Indobatrachus* Noble, 1930.

Indobatrachus trivialis sp. nov.

Pl. I. fig. 1.

Description:—The head is large, anteriorly rounded off rather obtusely, and has its posterior width only a little more than its length. The teeth sockets are seen on the maxillaries, pre-maxillaries and on the pre-vomers—on the last they are rather obscure. The presence of the various investing bones can be verified as mentioned above, by examining a series of specimens; but they do not permit of any detailed description.

The vertebral column consists of nine pro-coelous vertebrae, which are broader than long and have well marked zygapophyses. The third vertebra has its diapophyses a little longer than those of the fourth and the fifth vertebrae. The sacral diapophyses are broadly expanded. Between some of the vertebrae are seen minute discoid elements which are most probably the free intercentral discs. The coccyx has two condyles and no lateral processes. The length of the pelvis is slightly more than half of that of the vertebral column.

The humerus is nearly as long as the supra-scapula. The femur is a little shorter than the tibia-fibula. Of the meta-tarsal bones, the fourth one is the longest and the first one is the shortest; the second meta-tarsal is a little more than half the length of the fourth one, while the third and the fifth are sub-equal to each other. No inter-calary cartilages nor any space for them, is present. The phalanges are tapering and have minute terminal knobs.

In Table No. I are given the available measurements for five of the specimens representing the present species. The Table No. II gives the ratios of the measurements of the different parts of *Indobatrachus trivialis* sp. nov. and of *I. pusillus* (Owen).

COMPARISON.

To compare *Indobatrachus pusillus* (Owen)¹ with the present species, the first striking difference is found in the ratio of the length of the vertebral column to that of the pelvis, which is 181-183/100 in the new species and 150-153/100 in *I. pusillus* (Owen); this gives to the new species a little longish appearance as compared to *pusillus*. The ratio of the length of the head to its width is fairly different, being 94-95/100 in *I. trivialis* and 97/100 in *I. pusillus* (Owen). Again, the ratio of the length of the femur to that of the tibia-fibula is 96-97/100 in the present species and 100/100 in *pusillus*. Further, the species described here has slightly stouter bones than *pusillus* (Owen).

GEOLOGICAL AGE.

The lower Eocene age of the upper part of the Deccan Trap Series (which includes the Frog-Beds of Bombay) is to be accepted as very probable, since they are unconformably succeeded by the Nummulitics of Surat and Broach.² The genus *Indobatrachus* has its nearest allies in some of the living Australian bufonid genera.³ This relation as Noble points out, is of very great zoogeographic importance;⁴ but unfortunately it does not help us to fix the age of the Inter-trappean Beds of Bombay, on the basis of this genus. It is, however, to be hoped that some direct evidence bearing on this problem will come forth from the study of the crustacean fossils from these beds, with which the author is now busy.

¹ Noble 1930, pp. 2-9.

² The upper Eocene age assigned by Woodward (1932, p. 231) to *Oxyglossus pusillus* cannot be accepted.

³ Noble 1930, pp. 2, 8.

⁴ *Ibid.* p. 2.

TABLE NO. I

<i>Indobatrachus trivialis</i> sp. nov.					
	1	2	3	4	5
Total length of the body ...	...	...	...	...	...
Length of the head ...	20.3 mm.	20.65 mm.	18.4 mm.	17.0 mm.	17.6 mm.
Posterior width of the head ...	5.7 "	5.83 "	5.2 "	4.8 "	4.9 "
Length of the vertebral column ...	6.0 "	6.2 "	5.5 "	5.1 "	5.2 "
Length of the pelvis ...	13.8 "	14.0 "	12.5 "	11.61 "	12.0 "
Length of the humerus ...	7.6 "	7.73 "	6.84 "	6.33 "	6.6 "
Length of the radio-ulna ...	4.6 "	4.67 "	4.1 "	3.8 "	...
Length of femur ...	3.2 "	...	...	...	...
Length of the tibia-fibula ...	6.2 "	6.4 mm.	5.6 mm.	5.2 mm.	...
Length of the calcaneum-astragalus ...	6.4 "	6.6 "	5.8 "	...	...
Length of 4th meta-tarsal bone ...	3.4 "	3.42 "	...	...	...
Total length of the posterior limb ...	3.3 "	3.32 "	...	...	...
	27.5 "	27.68 "	...	...	...

TABLE NO. II

		<i>Indobatrachus pusillus</i> (Owen) *					
		<i>Indobatrachus trivialis</i> sp. nov.		From measurements of Owen's figure	From Noble's figure; Brit. Mus. specimen No. 35107 ^a	Brit. Mus. specimen No. 35107	Brit. Mus. specimen No. 3084
Skull length	...	94-95	97	?	?	?	?
Width	...	$\frac{100}{100}$	$\frac{100}{100}$				
Femur	...	96-97	100	100	100	99	100
Tibia	...	$\frac{100}{100}$	$\frac{100}{100}$			$\frac{100}{100}$	$\frac{100}{100}$
Hind limb	...	134-136.5	?	138	138	135	?
Body	...	$\frac{100}{100}$				$\frac{100}{100}$	
Vert. col.	...	181-183	?	152	152	150	153
Pelvis	...	$\frac{100}{100}$				100	100

* The ratios given below for this species were very kindly supplied by H. W. Parker, Esq., Keeper of the Reptiles Section British Museum, for which the author is much thankful.

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EXPLANATION OF PLATE NO. I.

Fig. 1.—*Indobatrachus trivialis* sp. nov., approx. x 1½.